

**INDEPENDENT ASSESSMENT ON EARTHQUAKE PERFORMANCE
OF
194 Gloucester Street**

**FOR
Royal Commission of Inquiry into building failure
caused by the Canterbury Earthquakes**

**Report prepared by Peter C Smith and Jonathan W Devine of
Spencer Holmes Ltd**

December 2011



Introduction

This report has been commissioned by the Royal Commission of Inquiry into building failure caused by the Canterbury Earthquakes to review the performance of the building at 194 Gloucester Street, Christchurch during the Canterbury earthquake sequence.

The report is based on documentation provided by the Royal Commission of Inquiry into building failure caused by the Canterbury Earthquakes. No inspection of the building was possible prior to demolition.

Location of Building

The building at 194 Gloucester Street was located on the south side of Gloucester Street between Latimer Square and Manchester Street. The location of the building in the Christchurch CBD is identified in the site plan in Appendix 1.

Description of Building

The building at 194 Gloucester Street was a three-storey un-reinforced masonry building with timber floors and timber roof framing. The building was originally constructed as a Trades and Labour Hall. At the time of the earthquake, the building consisted of a three storey unreinforced masonry building with timber floors and timber roof framing along the road frontage, a two storey building behind the three storey building and a single storey Trades Hall building to the rear. The building had substantial openings on the lower floor road frontage and lesser but still significant openings in the first and second floor façades.

The original complex, consisted of a two-storey building to the road frontage and a single storey hall to the rear. The complex was constructed in 1906. In 1916, a second floor was added to the hall at the rear. In 1924, a third floor was added to the front portion of the building and in 1960, a reinforced concrete lift shaft was added to the front building.

In a 1997 valuation report, the building is recorded as having been listed in the city plan under Heritage and Amenities as a protected building under Group 3 category.

Compliance

In 1975 Holmes Wood Poole and Johnstone undertook a structural assessment of the building. The report records that the brick parapets were removed in 1960 and replaced with a concrete parapet. This work was undertaken at the time the concrete lift shaft was constructed. The condition assessment undertaken records;

“Basically the building is in very sound condition. There is no evidence of any cracking of structural significance caused by recent earthquakes, shrinkage or thermal effects”.

The assessment commented that;

“The building, as is proved by its performance to date, is quite satisfactory structurally for all of the vertical and wind loads likely to be imposed upon it.

It has little earthquake resistance in its present state and would not satisfy the requirements of Section 301A of the Municipal Corporation Act."

Work undertaken in 1976 included the formation of two significant openings at ground level of the front façade, the installation of reinforced concrete frames in the openings and some diaphragm strengthening.

The securing work is shown on a Holmes Wood Poole and Johnstone's plan W1342/1A, 2 and 3. The work consisted of providing 16mm and 20mm rod tension bracing to the second storey of the rear block (to underside of existing ceiling) and for the second storey of the first block.

The rod bracing was connected to 80 x 80 x 6 M S Angles connected to the masonry walls with M12 bolts at 750 mm crs, the bolts being grouted into 20mm diameter holes in the unreinforced masonry walls.

In addition, the first floor diaphragm was connected to the un-reinforced masonry walls with 16mm bolts @ 1500mm crs with the bolts extending through the wall and 150 x 150 x 6 steel washers provided on the exterior of the building.

The 12mm chipboard overlay was fixed to the timber floor plate with 60mm x 3m nails at 125mm crs.

A valuation report by Don Turner & Associates in 1997 states "Structural Condition – Over the years several engineers have been involved with work or undertaken reports regarding various aspects of the building structure. In discussions with them, they were all of the opinion the building is well past any economic restoration. Essentially they consider the building to be in a serious state of structural deterioration and a potential danger to life in the adjoining properties".

Attached to the valuation report was a report by Falloon & Wilson, which states;

"both buildings are of similar construction i.e. load bearing masonry, exterior walls with timber floors (including ground floor) and lightly clad timber framed roofs. The main transverse internal wall adjacent to stairs and lift is at the junction of the two buildings and extends above the roof of the lower to form the rear outside wall of the front building.

The mortar used in the brickwork has been pointed with cement-sand mortar but it is lime mortar typically.

The timber floors are propped with cast iron circular columns and one assumes that the props support steel beams, which in turn carry the ends of timber floor joists.

Because the structural walls are constructed of unreinforced masonry, this building is "earthquake prone" in accordance with the Building Act 1991.

To be retained as a useful building, major extensive and comprehensive seismic strengthening will be required – a new frame inside the old skin and such activities would be done in conjunction with a retrofit to bring the other aspects of the space in line with current Building Code requirements. A refit would have to produce exceptionally attractive space to be economically viable and I doubt that this is practically possible.

Because this building is earthquake prone and as such is dangerous to occupants and adjacent property and persons, I recommend that it be demolished as soon as is practically possible."

These comments appear to be influenced by the objective of obtaining a demolition consent for a heritage building.

Eventually, the Category 3 Heritage building was sold to local property developer, Chris James, who converted it into offices and a café style bar.

In May, 1997 John Taylor wrote to Wade Hill advising that;

"The building was altered in 1960 with the addition of an extended concrete lift shaft and the replacement of the high level masonry parapets with a concrete band.

Further structural alterations were carried out in 1976, which included concrete frames to intended openings in the street wall and diaphragm strengthening at first and second floor levels.

Available information suggests that the current earthquake resistance of the building is close to the minimum requirement of the Building Act provided that no change of use is involved. If the building is retained for its current retail-commercial use, it is unlikely that significant strengthening work will be required to achieve the minimum requirements. We note however, that the requirement is only 10% of the current code value for a new building of similar construction and 20% of current "New Zealand Society For Earthquake Engineering guidelines".

If the use of the building is to be changed, significant costs would be involved in achieving the earthquake performance required by the Building Act. New structural frames are likely to be required within the existing building.

While the Council has some discretion in the application of the Building Act to heritage buildings, the philosophy of the Building Act suggests that a "recycled" building should achieve a level of occupant protection not significantly less than that required for a new building.

In common with many buildings of similar age, the fabric of the building can be regarded as an earthquake hazard in its present condition, however, the existing masonry is not so deteriorated that it cannot be adequately secured to a new base structure."

There are copies of plans for diaphragm upgrading and the detailing of the large openings to be formed in the street façade of the building, which were prepared, by Holmes Wood Poole and Johnstone in 1976.

In a letter of 29th May, 1997, Falloon & Wilson advised that the following securing work had been already undertaken;

1. Reinforced concrete parapet to front three storied building
2. Braced structural steel diaphragm under roof to rear two storied building
3. Braced structural steel truss/diaphragm under floor three to front building
4. Nailed sheathing to top of floor 1 both front and rear

5. *Bolting into brick boundary walls to tie walls to floor diaphragm*

Falloon & Wilson identified that the additional securing required was:

1. *Build new steel diaphragm/trusses under level two both buildings.*
2. *Bolt through external wall, plate washers on outside for new diaphragm/trusses and re-bolt the old.*
3. *Strip off sheathing to level 2 to expose "attractive" floorboards.*

In a subsequent letter Falloon & Wilson outlined the extent of work that would be required to convert the building into apartments.

In January, 2002, Holmes Consulting Group undertook a further assessment of the building. Holmes Consulting Group recorded that the strengthening work undertaken in 1976 was designed to a seismic load level of 0.05g, being the minimum legal requirement at the time. The building was assessed as having an elastic lateral load capacity of 12% of full code levels with a ductile capacity to about 25% of full code, limited by the performance of the existing diaphragms and the north facing masonry wall.

In June, 2002, the Christchurch City Council wrote to the then owner, advising that on undertaking the measures proposed by the owner in their letter of 17th June, 2002 (of which no copy is available), Christchurch City Council would consider Wave House to comply with the provisions of the Building Code for means of escape from fire provided the maximum occupancy of the building did not exceed 49 people and that the upper floor was not used for any purpose. "By adopting these measures you have now effectively changed the use of the building for the purpose of the Building Act". That use is now;

"Restaurant, bar, tavern and café on the ground floor only with maximum occupancy of 49 people".

The intended use specified in Building Consent Number 10020220 issued to you by the Council on 2nd April, 2002 will only be permitted once the work referred to in that building consent has been completed and a final code compliance certificate has been issued by the Council in respect of that work.

Should you allow the occupancy of the building to increase above 49 persons, or should you allow the upper floor to be used for any purpose, then that will constitute a change of use of the building for the purpose of the Building Act 1991. As has been pointed out to you, such a change of use would require alterations to the building in order to bring it into compliance with the provision of the Building Code specified in section 46 (2) of the Act. Section 46 (1) (a) of the Building Act provides that you must notify the Council in writing of any change of use where the change of use will require alteration to the building in order to bring the building into compliance with the Building Code."

In the letter dated 23rd January, 2003 Spence Consultants Ltd commented;

"Further to your letter of 23rd January and previous discussions with John Buchan and John Taylor last year, there is no change of use – the building is already designated hospitality business on the ground floor. The letter enquired whether an engineers report was needed."

A hand written note on a copy of the letter by Peter Harrow of the Christchurch City Council noted, *"Yes you are right, there is no change of use and the report is not required"*.

The Christchurch City Council records include a Producer Statement-Design from Powell Fenwick Consultants Ltd for *"mezzanine floor joists, floor support beams, associated posts and foundations (using assumed ground conditions), balustrades, stair and lateral stability"*.

A Producer Statement-Construction Review by Powell Fenwick Consultants in respect of pre-lining inspection was issued on 14th August, 2003.

A Heritage Assessment Statement of Significance records that the former Trades Hall at 194 Gloucester Street was listed as a Group 3 Protected Heritage Building in the Christchurch City Plan and is registered by the New Zealand Historic Places Trust as a Pouhere Toanga as a Category Group II Historic Place.

Christchurch City Council Policy on Earthquake Prone Buildings

We understand that the Christchurch City Council applied for and was granted powers under the Section 301A of the Municipal Corporations Act and that the Christchurch City Council adopted a passive approach to the upgrading of earthquake risk buildings.

The Christchurch City Council appear to have communicated the likely earthquake prone nature of a building to the owner when work was undertaken on the building and recommended that the owner obtain an engineers assessment of the building.

The Christchurch City Council did require structural upgrading in 1976 and Holmes Wood Poole & Johnstone's understanding of the Christchurch City Council policy in respect of earthquake risk buildings is recorded in their report which comments "We believe that the Christchurch City Council takes a realistic view of the powers it has and at present does not require under-strength buildings to be immediately attended to. Instead, they are conducting a survey of all such buildings within the City and are classifying them according to their condition. The Council have indicated that because this building has no dangerous parapets, it is essentially regular in plan, is adjacent to a footway which is not particularly busy and is in quite good condition they would classify it as a Class B building where Class A is the worst risk category. As such they would require that it be strengthened to comply with Section 301A or demolished within the next 10 years. Realistically speaking, it is quite probable that the 10 years would stretch to 15 years."

In November, 1991 the Christchurch City Council undertook a Seismic Risk Buildings – Survey of the building. The assessment notes that the parapets were of reinforced concrete. The assessment appears to be incomplete but to assign the building as a Category D building. Under the proposed Christchurch City Council assessment at that time, a Classification D building was assessed as "probably adequate if building is well maintained". The Hazardous Appendage-Survey identified minor loose masonry, noticeable mortar deterioration and minor cracking.

The Christchurch City Council's first policy in respect of earthquake-prone, dangerous and insanitary buildings policy was introduced in 2006.

This policy was reviewed in early 2010.

Events Subsequent to 4th September 2010 Earthquake

The building at 194 Gloucester Street was damaged by the 4th September, 2010 earthquake. A Rapid Assessment Form-Level 1 undertaken on 5th September, 2010 records moderate damage to walls and that the parapet on the south side had come down over the courtyard. The building was assigned a green placard with *"restricted access to the back courtyard due to brick fall"*. The assessment recommended a Rapid Assessment-Level 2 or detailed engineer evaluation.

An Intra RFS report dated 5th October, 2010, records *"Previous notice states toppling hazard at rear, no access through back doors to courtyard. Some minor cracking to side wall, part of rear parapet has been removed. Restricted access to back courtyard due to brick fall Level 1 – 2 detailed engineering evaluation recommended"*. A subsequent Intra RFS form advised a yellow notice to be served. On 12th October, 2010 the owners of the building were served with a Section 124 (1) (c) notice identifying that *"the building had been damaged and that there were structural defects to the building"*. The form identified that there were toppling hazards at rear and some minor cracking to sidewall. The owners were required to carry out work to remove the danger. The work was to be completed by 31st January, 2011.

In the week following the 4th September, 2010 earthquake, the owners engaged BCH & Ferner Ltd to undertake a Rapid Assessment-Level 2 of the building. The Rapid Assessment-Level 2 dated 6th September, 2010 identified wall or other structural damage, that the parapet at the back had collapsed, and that there was cracking to the upper level brick walls. The building was assigned a yellow placard. The Rapid Assessment identified that there was *"No significant diaphragm"* and that there should be *"No entry to restaurant – overhead parapet collapse"*

BCH & Ferner Ltd developed a scheme for strengthening the building to 67% of NBS. The scheme was assessed to cost \$2.7 to \$3 million dollars. The report was published on the 14th December, 2010.

The building was further damaged in the 26 December, 2010 earthquake. The USAR Damaged Building Reconnaissance Report identified severe damage to the building and assigned a red placard to the building. It identified that an engineering assessment was required.

A subsequent report on the same date notes *"West parapet fallen, top N.W window loose 6 inches"*. The assessment identified urgent action in respect of additional cordon / fencing required.

The Christchurch City Council issued a Section 124 (1) (c) Building Act 2004 Notice to the owners on 27th December, 2010 requiring the building owners to remove the danger.

An Intra RFS record sheet on 29th December, 2010 comments *"Red stickers with 124 notice issued 27/12/10. Owner wants to discuss demolition with Council. Building is unsafe"*.

By the 5th January, 2011, BCH & Ferner Ltd had prepared a series of photographic records identifying the work that BCH & Ferner Ltd assessed to be necessary to secure the building sufficient for inspection. Refer Appendix 2. These records show quite severe cracking of the upper floor west wall of the building and on 6th January, 2011 an engineer from BCH & Ferner Ltd inspected the upper portions of the building using an overhead crane. The engineer concluded that the entire west wall of the top floor was in a precarious condition and need to be taken down immediately in order to make the structure safe and enable an internal inspection to take place.

The Christchurch City Council Engineer Re-inspection of Damaged Building report of the 3rd February, 2011 identified that repair work was in progress.

Work undertaken under BCH & Ferner Ltd's control included the removal of the concrete parapet and un-reinforced masonry to the west wall above second floor level, including the return to the first opening along the north wall. The un-reinforced masonry was replaced in timber construction. (Refer Appendix 3).

On 14th February, 2011 BCH & Ferner Ltd advised the owners that;

"on the basis of a visual inspection of the building conducted on 14th February, 2011 we are satisfied on reasonable ground that any potentially dangerous features had been removed or secured, and that the stability of the structure was sufficient that it does not pose a threat to adjacent buildings or the public that is significantly greater than prior to the earthquake.

Notwithstanding the above, the building has suffered damage from the recent earthquakes and is potentially earthquake prone. The inherent risks due to being a potentially earthquake prone building still exist. We are currently undertaking further investigations and assessment work to develop appropriate remedial / strengthening work (if required) for the building".

The building was seriously damaged as a result of 22nd February, 2011 earthquake. A Rapid Assessment-Level 2 undertaken on 26th February, 2011 assigned a red placard to the building and commented "building has almost completely collapsed". The recommendation was to demolish the building urgently. The assessment commented "the unreinforced masonry building has suffered significant collapse to both the front and rear of the building. Repair or strengthening will not be possible".

Approval for demolition was granted on 3rd March, 2011 and the building was recorded as having been demolished by 22nd March, 2011.

Structural Failure

Examinations of photographs of the building 194 Gloucester Street following the 22nd February, 2011 earthquake establish that the building suffered a substantial collapse of the east and west walls, refer Appendix 4, and of the north wall above second floor level. The east wall separated from the north wall with a near vertical tear from ground level to the parapet level of the original two-storey building. A central portion of the east wall below first floor level remained standing. The remainder of the wall appears to have rotated outwards under the severity of shaking present in the 22nd February, 2011 earthquake.

The north wall failed outwards just above the original two-storey building at second floor level. The line of failure is assumed to be the top off the original parapet to the north wall when the building was two storeys in height. There was also a substantial failure of the west wall above first floor level. The failure at the junction to the north wall has occurred through the openings present at the west end of the north wall.

The formation of the openings in the north wall in 1976 appear to have had no influence on the building failure.

The code lateral load coefficient for a façade to an elastic responding structure in Christchurch at the time of the earthquake sequence was 1.23g at roof level of a three storey building. The analysis of un-reinforced masonry construction is not covered in the New Zealand Building Code. The industry uses the New Zealand Society for Earthquake Engineering guidelines 'Assessment and Improvement of the Structural Performance of Buildings in Earthquakes' 2000 and 'Assessment and Improvement of Un-reinforced Masonry Buildings for Earthquake Resistance' 2011. Calculations using these documents indicate that a sound 225 mm thick unreinforced masonry wall spanning 3m from third floor to roof level and effectively restrained at roof level would not have met code requirements without strengthening.

Based on GNS Science records of measurements of accelerations in the Christchurch CBD during the 22nd February, 2011 earthquake, the building is likely to have been subjected to a ground acceleration of 0.9g. This level of ground acceleration equates to a 1.68g acceleration at roof level. In addition significant vertical accelerations are known to have occurred and it is probable that the façade was subjected to a vertical acceleration at the same time as being subjected to severe horizontal acceleration. Clearly the failure of the unrestrained Gloucester Street facade was almost inevitable under the severity of loading that occurred on the 22nd February 2011.

Issues Arising from Review

Structural condition of building prior to 22nd February, 2011 earthquake

As a result of damage to the west wall in the 26th December, 2010 earthquake, Beca required the west wall above level 2 to be demolished. The instruction was relayed by comments imposed on photos of the building. The work involved the removal of the parapet and damaged brickwork to the west wall above second floor level, and the demolition of brickwork extending over a small portion of the north wall.

The west wall above level 2 was replaced with a timber-framed wall clad in plywood.

Prior to the demolition of the west wall above 2nd floor level, there was a concrete parapet above the brick wall. The parapet provided some restraint of the NW corner of the building at roof level. The parapet does not appear to have been continuous at the SW corner of the roof and this appears to be a hazard that was not reported on by previous engineering assessments.

An assessment of the extent, if any, that the removal of the parapet may have had on the restraint of the north wall near the NW corner of the roof has not been possible. In the absence of details of the connection of the timber framing and the plywood construction to the un-reinforced masonry construction and parapet, we are unable to be conclusive in our findings.

We are satisfied however, that the shaking that occurred on the 22nd February, 2011 was sufficiently severe that the restraint that existed prior to the 26th December, 2010 earthquake would not have prevented the substantial collapse that occurred in the 22nd February, 2011 earthquake.

Upgrading un-reinforced masonry buildings

The damage that occurred to the building in the 22nd February, 2011 earthquake demonstrates the risk that un-reinforced masonry buildings pose to the occupiers of the building and people in the vicinity of the building at the time of such an event. Tragically the earthquake sequence has

highlighted the danger to the public of inadequately restrained facades to many un-reinforced masonry buildings.

The delay in the Christchurch City Council implementing a policy on earthquake prone buildings may or may not have contributed to the damage which occurred following the severe shaking that occurred during the 22nd February, 2011 earthquake. It is suggested that in the interests of public safety, territorial authorities should be more active in requiring building owners to strengthen un-reinforced masonry buildings, and to remove or secure the parapets and facades to buildings along street frontages. Undoubtedly the Christchurch City Council's attitude to earthquake risk buildings was influenced by the perception that Christchurch was a low seismic hazard zone.

Basis of Rapid Assessments/Structural Assessments

The Rapid Assessment and the structural assessments focused on damage caused to the building by the recent earthquake. Historically, aftershocks have caused lesser levels of shaking than the initial earthquake. The Canterbury series of earthquakes has tragically identified the potential for an aftershock, with an epicentre closer to a developed area, to subject that area to more severe shaking than the initial earthquake.

It is suggested that when there is a risk of a significant aftershock after a significant earthquake, controlling authorities should require engineering assessments of earthquake prone buildings to a minimum strength requirement prior to allowing public access into the building or the potential fall zone of any building façade or other perceived danger.

Change of Use

The Christchurch City Council's approval of building consent 10020220 in April, 2002 appears to be on the basis that the Christchurch City Council did not deem the restaurant, bar, tavern and café on the ground floor with a maximum occupancy of 49 people to be a "change of use". Any upgrading of the upper floor to the building, which was to remain empty, would constitute a change of use which would require upgrading of the building to a strength level as near as is reasonably practicable to current code requirements.

This position appears to be confirmed in a letter by Spence Consultants Ltd to the Christchurch City Council of 23rd January, 2002 in which Gary Spence comments "further to your letter dated 23rd January and previous discussions with John Buchan and John Taylor last year, there is no change in use and that – the building is already designated hospitality business on the ground floor.

The letter enquired as to the need for an engineers report. A written comment is included on a copy of the letter stating, "Yes you are right, there is no change of use and report is not required".


It would appear that the Christchurch City Council's interpretation was that no "change of use" occurred.

Report Prepared By:-



Peter C Smith
BE, FIPENZ, CP Eng IntPE
Director

Report Reviewed By:



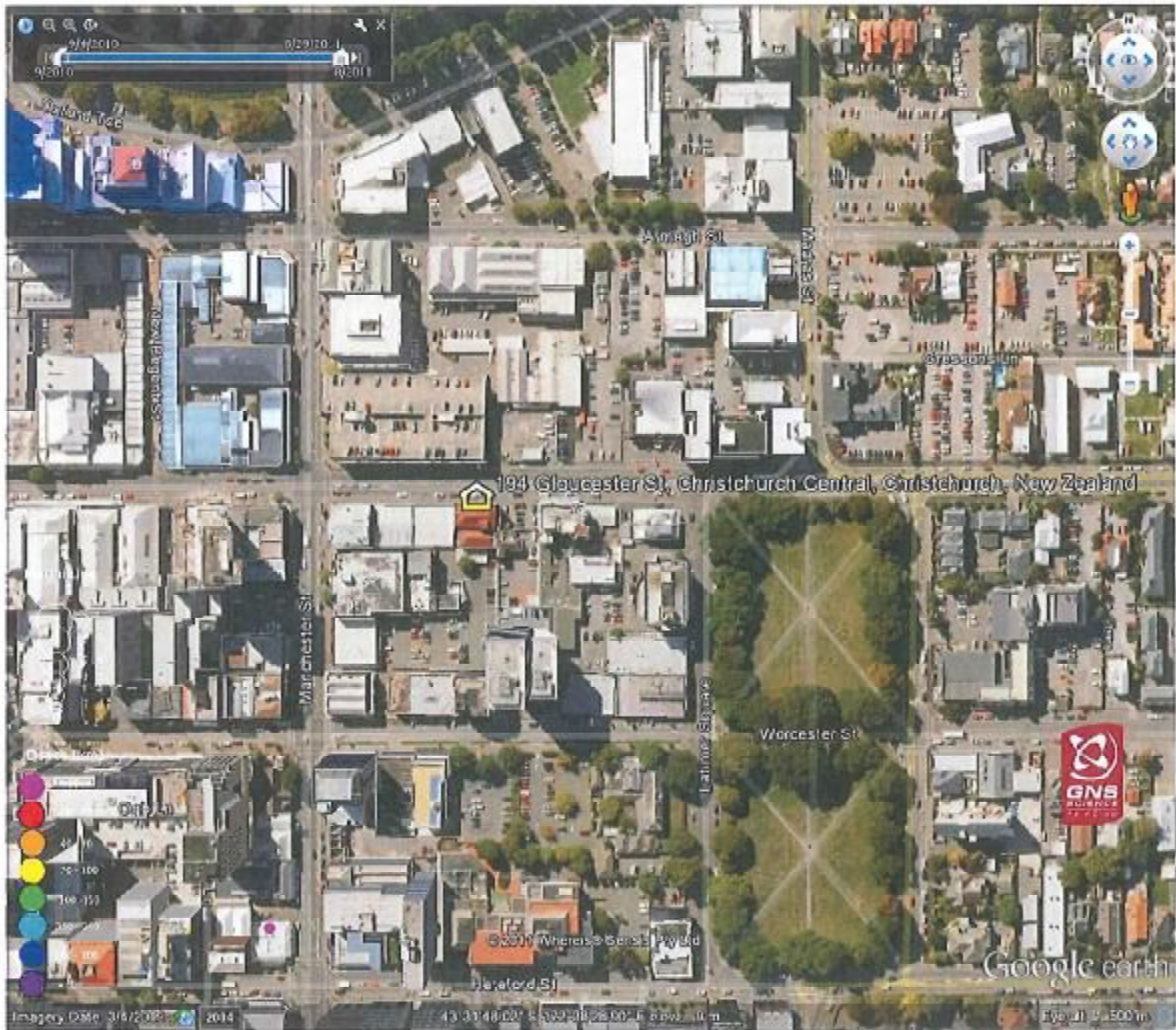
Jon Devine
BE(Hons) ME (Civil) CP Eng IntPE
Director

G/E110604 - 194 Gloucester Streetsheet Dec '11.doc

APPENDIX 1

Site Plans





APPENDIX 2

Remedial work after 4th September, 2010 earthquake



Level 3, Pricewaterhouse Coopers Centre, 119
Armagh Street
PO Box 13960, Christchurch 8141, New Zealand
T: +64 3 366 3621 / F: +64 3 366 3188
E: info@beca.com // www.beca.com

HTP9 Trustee Ltd
c/- Devonia Realty Ltd
P O Box 13057
Christchurch
New Zealand

14 February 2011

Attention: David Wallace

Dear David

194 Gloucester Street - Structural Assessment

Beca Carter Hollings and Ferner (Beca) has been engaged to inspect and to advise the Owner on, the interim securing / strengthening of the above building following the Darfield earthquake of 4 September 2010 and subsequent aftershocks.

On the basis of a visual inspection of the building conducted on 14 February 2011, we are satisfied, on reasonable grounds, that any potentially dangerous features have been removed or secured, and that the stability of the structure is sufficient that it does not pose a threat to adjacent buildings or the public that is significantly greater than prior to the earthquake.

Notwithstanding the above, the building has suffered damage from the recent earthquakes and is potentially earthquake prone. The inherent risks due to being a potentially earthquake prone building still exist. We are currently undertaking further investigations and assessment work to develop appropriate remedial / strengthening works (if required) for the building.

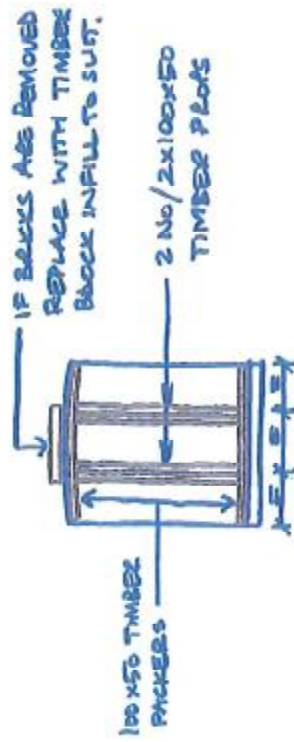
Yours sincerely

Samir Govind
Technical Director - Structural Engineering

on behalf of
Beca Carter Hollings & Ferner Ltd
Direct Dial: +64-3-374 3145
Email: samir.govind@beca.com

Our Ref: 5321140
NZ1 400033 3 0.3

PUSH BACK LOOSE BRICK TO WINDOW LINTEL INTO PLACE IF POSSIBLE (PREFERABLE OTHERWISE REMOVE LOOSE BRICK (STORE AWAY SAFE)). PROP ALL 3 WINDOWS WITH TIMBER AS FOLLOWS:



ELEVATION

When close examination (via crane) western wall level 3 to roof top floor will need to be removed to make safe, large sketch sk7 for extent and details.



PROJECT NO:	194 GLOUCESTER STREET
DRAWN BY:	SPENCER HOLMES LIMITED
CHECKED BY:	SPENCER HOLMES LIMITED
DATE:	05/07/2011
SCALE:	AS SHOWN
PROJECT NO:	5921140 - SK 5 10 2



CLOSE UP VIEW SHOWING LINTEL
DAMAGE TO WINDOW ON WESTERN
FACE.



PROJECT FILE	M14	194 GLOUCESTER STREET
DRAWING TITLE	WESTERN ELEVATION	WINDOW DAMAGE
ISSUED	5/5	DATE: 5/5
ISSUE DATE	25/01/2011	APPRO: [Signature]
SCALE AS SHOWN	1:1	REVISIONS
BECA DATE FOR	23-11-09	REV 1

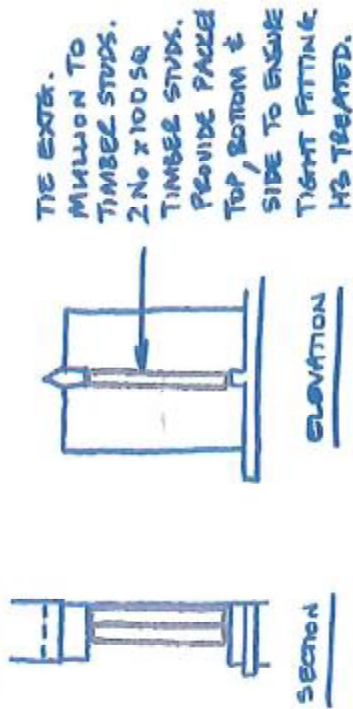


REMOVE LOOSE BRICKS. WHOLE BRICKS TO BE STORED AWAY SAFELY (PACK ON PALETTE AND STORE IN COURTYARD AT REAR) FOR REUSE IN FUTURE IF REQUIRED. ANY DAMAGE BRICKS TO BE CARRIED AWAY.



PROJECT TITLE	194 GLOUCESTER STREET
DRAWING TITLE	BRICKS AND GROUND
ISSUED	ISSUED BY
DATE	DATE
SCALE AS SHOWN	NTS
PROJECT NO	524140 - S&S (BY 1)
	

CAREFULLY REMOVE STONE WINDOW MULLIONS AND STORE AWAY SAFE (COURTYARD) FOR REUSE IN THE FUTURE IF REQUIRED. PROVIDE TEMPORARY PROPS WITH TIMBERS AS FOLLOWS:



PROJECT FILE	194 GLOUCESTER STREET
DRAWING TITLE	WINDOOR WALL - MULLION & DRAWING
DRAWN	RS
DATE DATE	05/01/2011
SCALE AND DIMENSIONS	AS SHOWN
REVISION NO.	001
REV	001



CLOSE UP VIEW SHOWING DISPLACEMENT
OF STONE WINDOW MULLION ON
NORTHERN FACE.



PROJECT NO	194 GLOUCESTER STREET
DRAWING TITLE	PROPOSED RESTORATION WORKS
DATE	05/01/2011
ISSUED BY	SG
CHECKED BY	SG
DESIGNED BY	SG
SCALE	AS SHOWN
PROJECT NO	194 GLOUCESTER STREET
Becca	

CLOSE UP VIEW SHOWING DISPLACEMENT
OF STONE WINDOW MULLION ON
NORTHERN FACE.



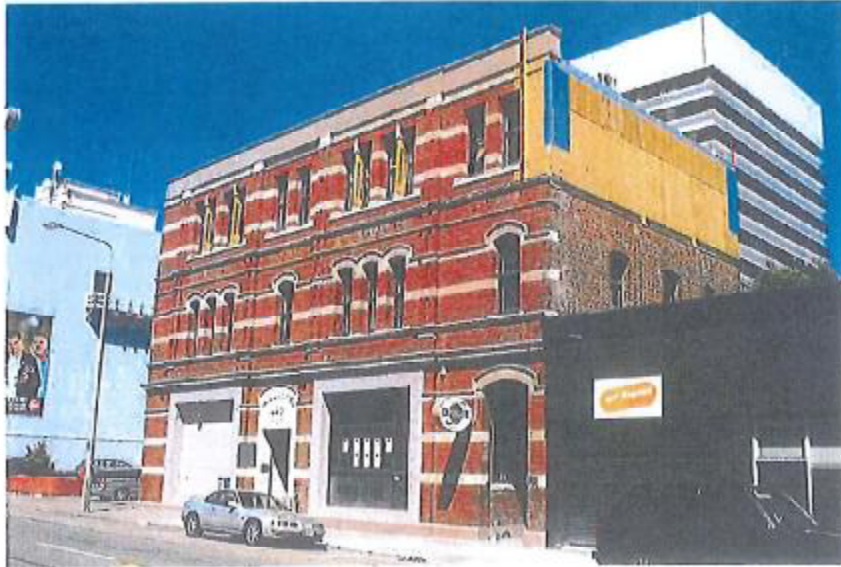
PROJECT NO:	194 GLOUCESTER STREET
DRAWN BY:	INTEGRAL SOLUTIONS
DATE:	05/01/2011
SCALE:	1:1
PROJECT ADDRESS:	194 GLOUCESTER STREET, SYDNEY
CLIENT:	INTEGRAL SOLUTIONS
PROJECT NO:	194 GLOUCESTER STREET

APPENDIX 3

Photos taken following securing works undertaken by Beca following 26th December, 2010 earthquake.

BUI.GLO194.0008A.1

Site Visit - 16 February 2011



1 of 10

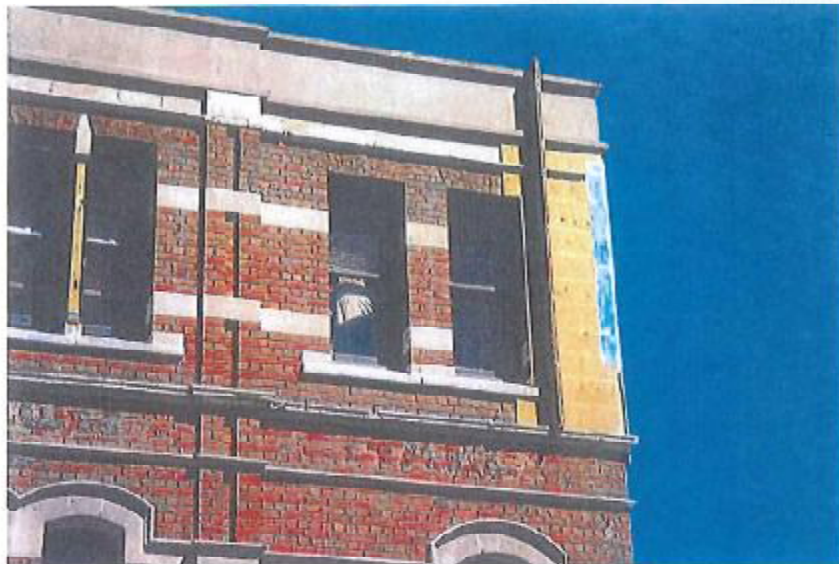


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BULGLO194.0008A.3



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BUI.GLO194.0008A.4



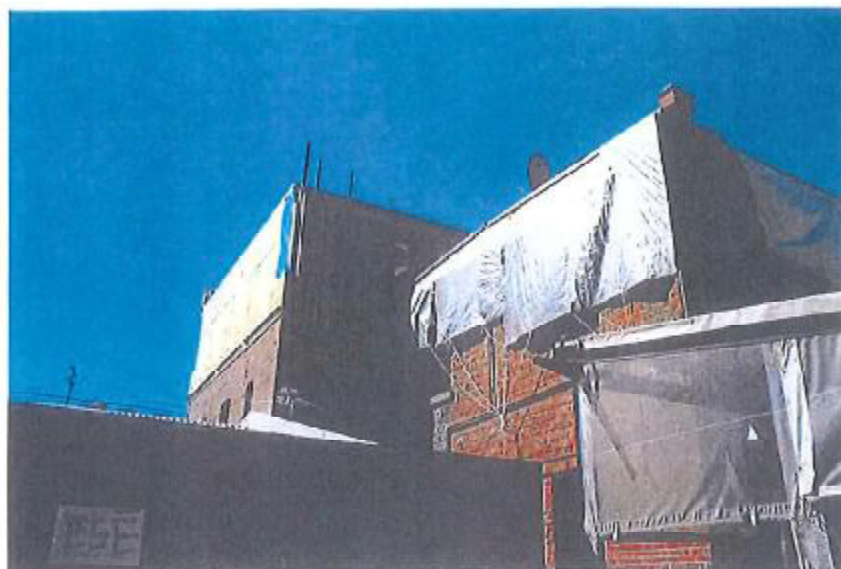
4 of 10

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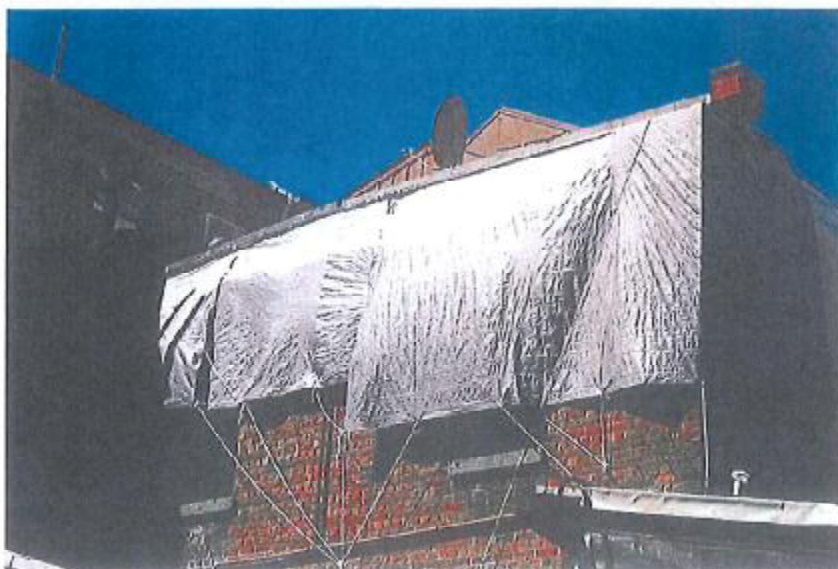
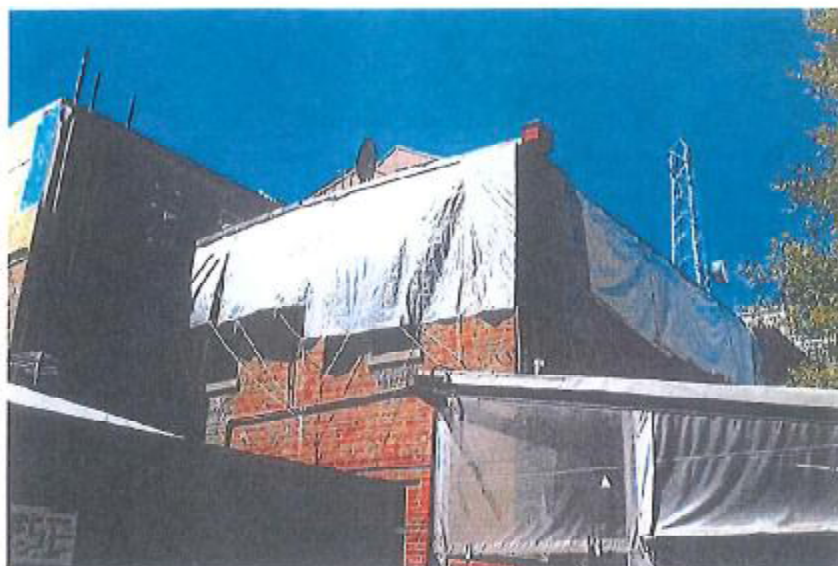
6 of 10

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BUI.GLO194.0008A.8



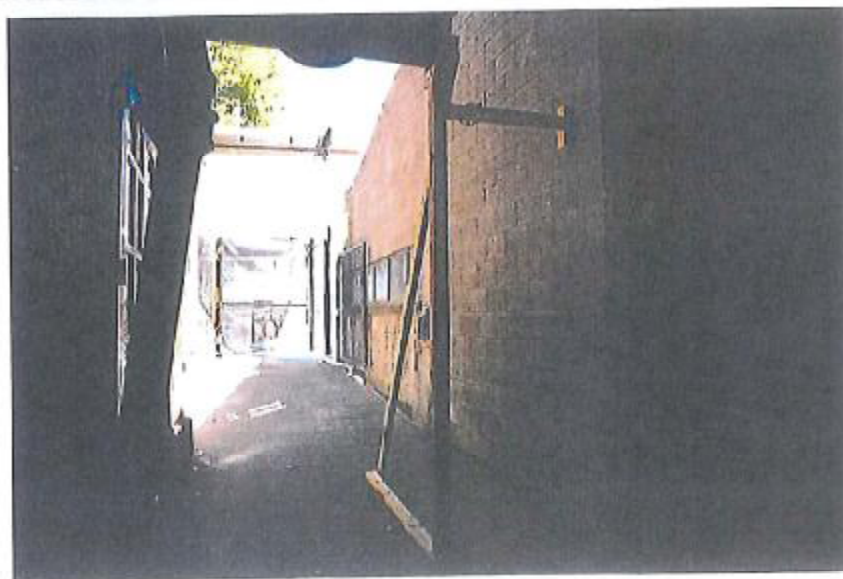
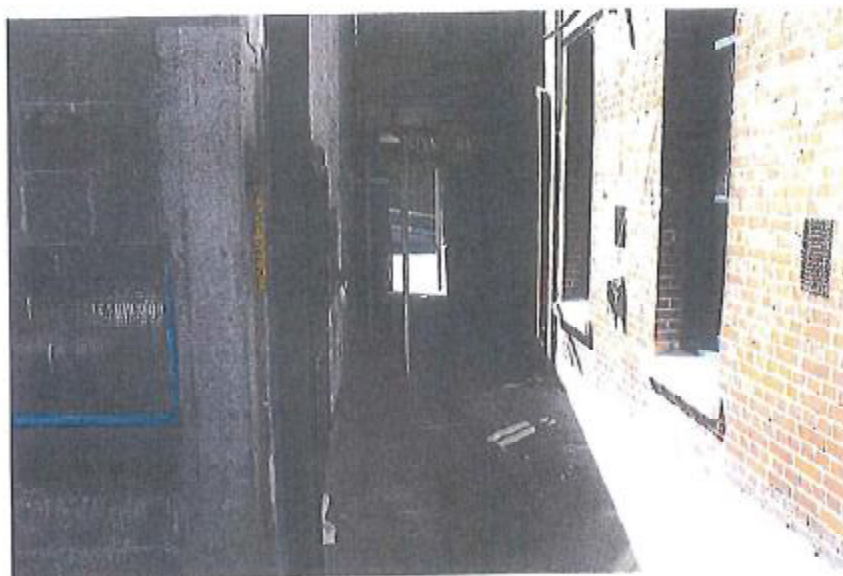
8 of 10

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BUI.GLO194.0008A.10



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APPENDIX 4

Photos after 22nd February, 2011 Earthquake



ArcGIS ImageCache API-1822 Christchurch cache

Page 1 of 1

ArcGIS JavaScript API: LINZ/Christchurch_cache

Built using the [ArcGIS JavaScript API](#)



http://data.govt.nz/arcgis/arcgis-services/LINZ/Christchurch_cache/MapServer?F=json

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